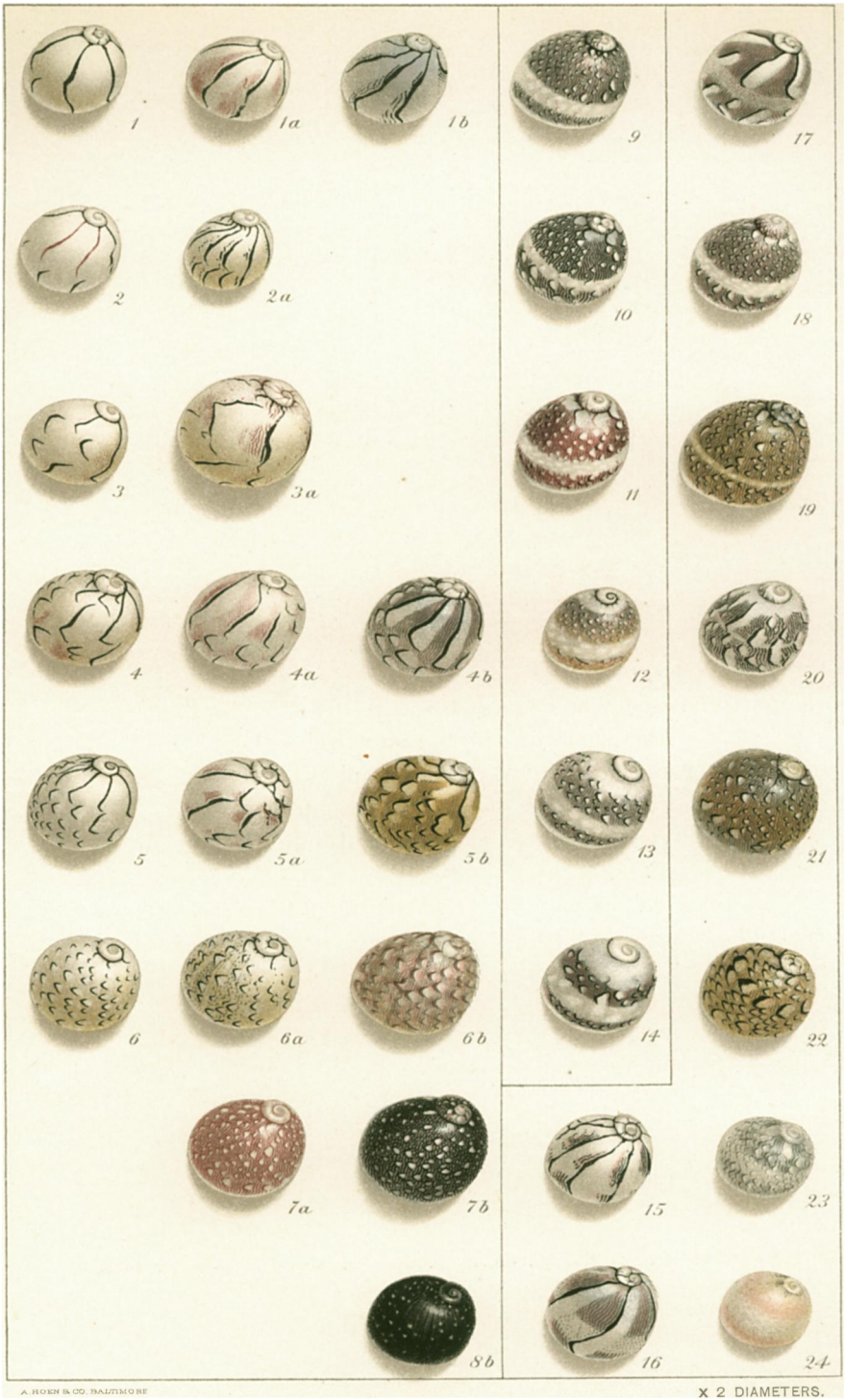
Neritina virginea, *variety* minor.



A. HOEN & CO. BALTIMORE

X 2 DIAMETERS.

NERITINA VIRGINEA VARIETY *MINOR*.[1]

MAYNARD M. METCALF.

WHILE collecting one summer in Jamaica, W. I., the author visited the "Salt Pond" near Port Henderson. This shallow pond is separated from the ocean by a narrow strip of sand over which the waves break during heavy storms. It has no outlet to the ocean and no fresh water streams flow into it. The water thus comes to be considerably more salt than that of the open ocean. The sample of water from these ponds which the author examined had a specific gravity of 1.038.

The fauna of this pond is quite rich and includes some very interesting forms. One is especially attracted to the beautiful little Neritina which literally covers the beach for rods near the water's edge. From a double handful of these animals scooped up in one spot on a little sand bar near the shore, the author has selected the shells in the accompanying plate. They are arranged for use in another publication and are designed to show a remarkable example of diversity. I would like here to call attention not only to the diversity but also to the dwarfing of these shells and its apparent cause.

Neritina virginea is a widely distributed littoral marine species. Full grown adults from the ocean are of the size of the figures on the accompanying plate. They show the same types of color and color pattern. Other types also are found among both the open ocean shells and those from the Salt Pond, but I have not attempted to figure them.

It is interesting to find that the Neritina of the "Salt Pond" is a dwarf variety. In almost every regard except size the animals resemble their ocean relatives, but their size is much less. The diameter of an average sized shell from the Salt Pond

[1] By the courtesy of The Macmillan Company the author is permitted to use for this article the accompanying plate which he has prepared for use in *An Outline of the Theory of Organic Evolution*, now in press.

would be about half that of an average shell from the open ocean. The figures on the plate are enlarged two diameters.

Apparently the extra salinity of the water in the Salt Pond has dwarfed the animals. That they are not young individuals is indicated by the facts (1) that no individuals of larger size were found, (2) that no smaller ones were found, indicating that they were not breeding at the time these shells were gathered. It can hardly be supposed that both the very young and the adults hide themselves from view, while the half-grown individuals crowd upon the shore in numbers that literally cover the sand at the water's edge. Yet the author should mention that he has seen a letter to Professor E. A. Andrews in which reference was made to these shells, called by the natives *Bossu*, saying that they are used for food and are gathered in fresh water streams at night with lanterns, but that during the day they hide under stones and can be found only with difficulty. There seems little doubt that the form from Salt Pond Neritina is a dwarf variety, and if so, the most probable cause of the dwarfing seems to be the density of the water in which they live.

It is still more interesting to find that a similar dwarfed Neritina occurs in fresh water streams in Jamaica. Professor Andrews has collected them in a small stream at Port Antonio, and the same letter referred to above mentions their occurrence in Mabess River, a branch of Spanish River near Buff Bay. Doubtless they occur in other Jamaica streams.

The author has about five hundred shells collected for him by Dr. F. S. Conant in "a small stream at Port Antonio," probably the same stream in which Professor Andrews saw them. These shells are all small, — no larger than those from the Salt Pond. Among them are some that are very small and apparently immature. Careful search should be made for full sized individuals in these streams before we can be positive that none are present. This the author has been unable to secure. Such data as we have, however, especially in comparison with the Salt Pond conditions, seems to indicate the probability of these fresh water Neritina shells being a dwarf variety.

If this conclusion is correct we have the very interesting phenomenon of an animal normally living in the ocean able to adapt

itself to life in fresh water or to water of greater salinity than that of the ocean, but unable to attain its full size except in the ocean.

The dwarfed forms may fairly be called a variety, though their difference from the ocean forms be only one of size probably directly due to increased or decreased salinity of the water in which they live.

The great diversity in color and in color pattern found in *Neritina virginea* is well known, yet it may be worth while to call attention to the completeness of the intergrading between any two types, however divergent.

Color shade. — Note first the differences in the ground color of the shells: yellow in 5*b*, 19, and 22; white in all the rest. Observe that the colored lines are black in 1, 3, 5, 5*b*, 6, 6*a*, 19, 20, 22; purplish in 6*b* and 11; red in 7*a*; gray in 23; black and red in 2; that the major lines are black and the minor lines red in 1*a*, 3, 3*a*, 4, 4*a*, and 5*a*; that the major lines are black and the minor lines purple in 4*b*, 17 and 16.

Color pattern. — 1 is marked with a few heavy lines. From 1 to 6 these major lines become broken up into small V-shaped loops. In the shells *a* accessory minor lines are added. In the shells *b* these are more numerous.

Series 9 to 14 shows diversity in the pattern near the apex of the coil: 9 has a few slightly larger white dots near the coil, 10 has larger dots here, 11 has them very large; in 12 they have united to form a continuous white band; in 13 and 14 this band is wider.

Series 15 to 24 shows diversity in the character of the equatorial light band. In 15 and 16 only the minor lines are interrupted or faint along the equator of the shell; in 17 the major lines also are interrupted; in 18 the band is almost clear white; 19 and 20 show narrower bands; in 21, 23 and 24 the equatorial band is shown by a difference of color in and under the pattern; in 22 the equatorial line is faintly indicated in the pattern itself, being bordered above and below by large, heavy, black loops.

The shells figured are but a few selected from the large number collected. Other types of color and of color pattern were

found. Between any two of the shells collected, no matter how divergent in type, a completely intergrading series could be found.

It is doubtful if these colors and color patterns are of protective value. The shell is enclosed by flaps of the mantle most of the time rendering the coloration invisible. Also all types of color pattern are seen in one locality. Then, too, the animals are in such great numbers that they could hardly escape the observation of their predatory enemies, if such they have, by means of their coloration.

The shells shown as numbers 5*b*, 8*b*, 19 and 22 are from Port Antonio, probably from the stream in which Professor Andrews found Neritina, a small shaded stream with a dark bottom of vegetable mould. One can readily observe that the shells from the Port Antonio stream are darker than those on the unshaded, light-colored sand beach of the Salt Pond. Few of them resemble numbers 1 to 5 or the *a* shells of the accompanying plate. Most are heavily marked with dark lines, many of the type shown in 8*b* being found. As a whole, the shells from the stream average much darker than those from the Salt Pond. Also it is noticeable that the ground color of almost all of these fresh-water shells is yellow, while that of the Salt Pond shells is white.

Remembering that it is doubtful if the coloration of these shells is to any considerable extent protective, it is interesting to find that the darker-colored shells are found in the midst of dark-colored surroundings, in a shaded stream, while the lighter-colored shells are from an unshaded beach of light-colored sand.

Comparison with the collections of *Neritina virginea* in the United States National Museum and in the Museum of the Philadelphia Academy of Sciences shows that the color of the Jamaica Salt Pond shells averages considerably lighter than that of shells from the ocean, the ground color being a clearer white, and shells of the patterns represented in figures 1 to 6 and 1*a* to 6*a* being present in larger proportion.

Few, if any, finer examples of diversity in color and in color pattern are known. The same types of coloration are found in the full grown shells from the ocean. In the absence of breed-

ing experiments, if it were not for the completely intergrading forms, systematists would probably have no hesitation in recognizing several species. As it is, all must without doubt be included in one species, and it seems hardly worth while to name as varieties (*punctata, lineata, bilineata, trilineata,* etc.) even the most divergent types. The dwarf forms, however, might fairly be called variety *minor*.

The writer would suggest that, if the difficulty of rearing these animals be not too great, it is probable that they would be favorable subjects for breeding experiments.

The Woman's College of Baltimore,
April 25th, 1904.